Comparing Emissions Benefits from Regulating Heavy Vehicle Idling

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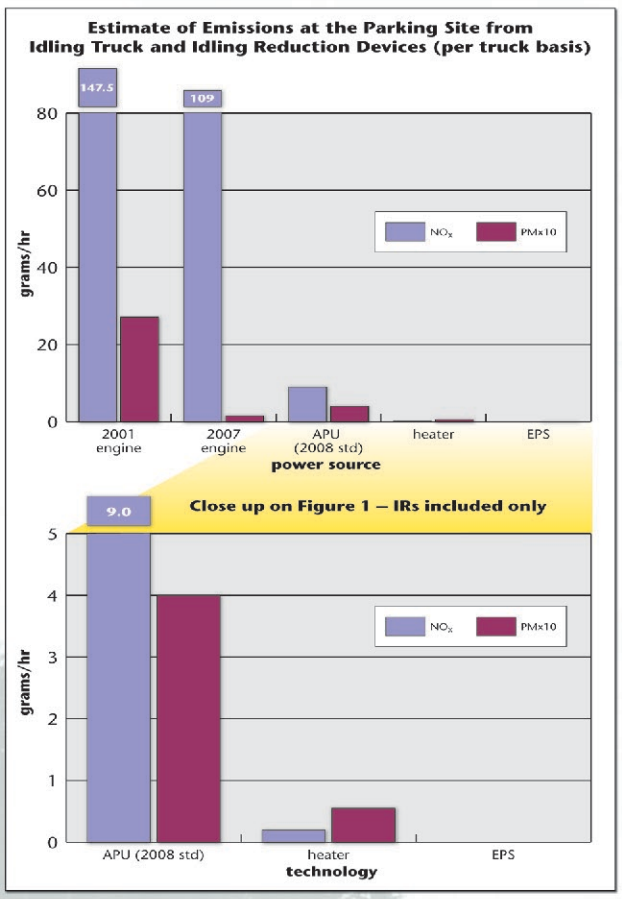
Background

Numerous states regulate long-duration diesel engine idling as a way to reduce emissions and improve air quality. What impact do those regulations actually have on emissions, and how do they affect adoption of idling reduction (IR) technology?

Current idling regulations are inconsistent from state to state; some proposed regulations could further increase these disparities and impede implementation of IR technology.

This study compares the potential air quality benefits from such regulations as a function of regulatory limits and exemptions.

Comparison of Emissions from Idle Reduction Equipment

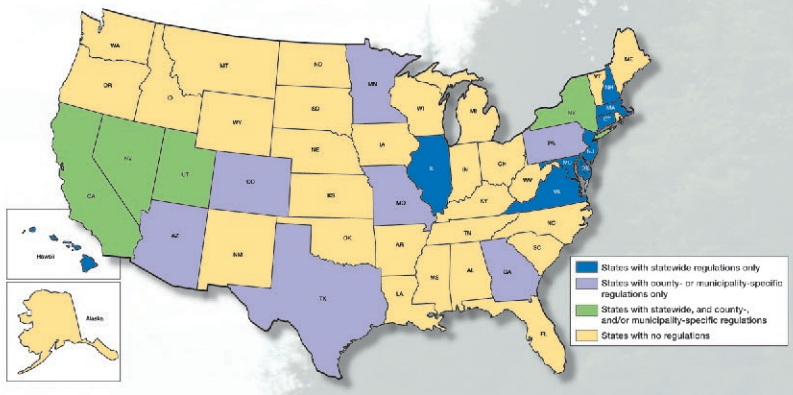


Assumptions

The current analysis assumes the following:

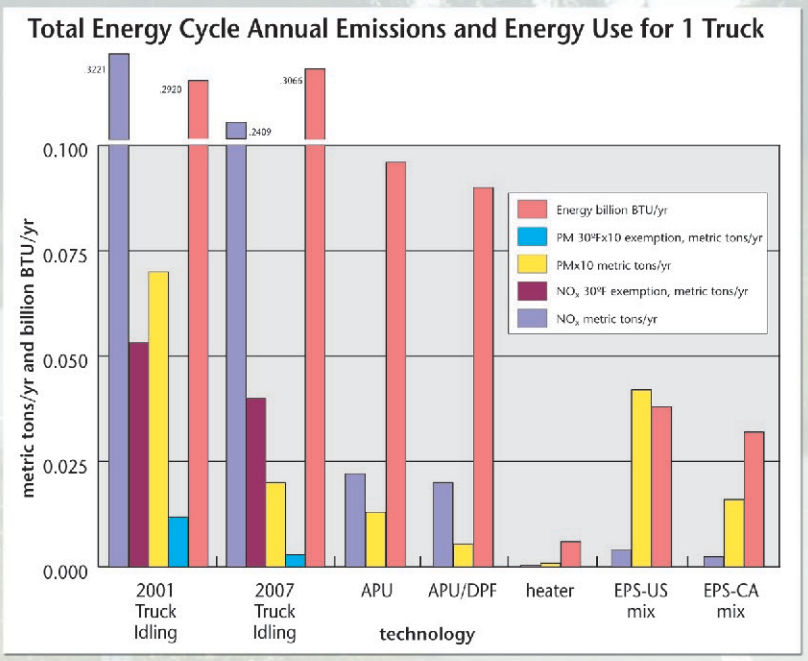
- Cab comfort devices were assumed to operate 7 hours/day, 303 days/year, except for the heater, which runs 150 days/year.
- Heater and current truck idling emissions and fuel consumption were derived from EPA (Lim, 2002) measurements, assuming 50% air conditioning and 50% heat.
- Emissions from 2007 engines were based on California Air Resources Board's estimates (CARB ISOR, 2003), as no measurements are available. Fuel consumption was assumed to be 5% greater than current trucks' due to emissions control equipment.
- APUs are expected to surpass 2008 standards when 2007 trucks are introduced; PM emissions were assumed to be 50% of the standard, in keeping with current surpassing of standards. NO_x emissions were assumed to be 60% of the combined NO_x + hydrocarbon (HC) small-engine standard. Fuel consumption was derived from measurements of a Caterpillar APU. Addition of a DPF was anticipated to reduce particulate matter (PM) emissions by 90%.
- Total energy cycle impacts were generated by adding the direct emissions and energy consumption to the impacts from producing the diesel fuel burned, as calculated from the Argonne GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model. Similarly, impacts from electricity generation were estimated from GREET, for both US average and California generation mixes.

Idling Regulations Today



Results

Idling reduction (IR) devices: All of the idling-reduction options enable significant reductions in energy use and all emissions compared to idling of current trucks, and also compared to 2007 trucks except for PM (see discussion at right). There are pros and cons for each type of device considered here. Heaters offer the lowest impacts but do not supply all cab comfort services. Auxiliary power units (APUs) supply all necessary services and can be used anywhere, any time the driver needs them. Electrified parking spaces (EPS) have zero impacts at the parking location, and most of their life cycle impacts are below those of the APUs because electricity generation at a large power plant is almost twice as efficient as it is in the APU (17 vs 31%). In addition, almost no power plant energy is in the form of oil. But parking must be restricted to equipped spaces, and there are economic problems getting that infrastructure (and any needed on-board equipment) in place. The first market for EPS use is likely to be for fleets with fixed routes.



Regulatory impacts: A sleeper exemption, would, of course, result in no reduction in the significant impacts from overnight idling. A temperature cutoff, below which trucks would be permitted to idle, would reduce sleeper impacts, but would compromise driver comfort when the temperature is just above the cutoff. We show the impact of a cutoff that would allow idling about 50 days per year (assumed to be 30°F for a moderate climate zone). If a locality instituted a short-time (e.g., 30-minute) exemption, sleeper impacts could be reduced more, but with potentially severe driver comfort issues. A timed exemption would enable significant idling during the course of the work day. On the whole, it appears that use of IR devices offers greater potential for reduction of long-duration than do regulatory approaches. Therefore, incentives to encourage purchase of IR equipment should be seriously considered.

Particulate matter (PM)

There is special concern because PM from diesel exhaust has been declared to be an air toxic. PM emissions for all of the IR devices are much lower than those from idling current engines. However, PM emissions from APUs and from EPS may be somewhat higher than from idling 2007 engines. Although no data are available yet on 2007 engine idling emissions (or on any engines running on ultra-low sulfur diesel), the Air Resources Board in California has proposed a regulation that would require particulate filters or other control measures on the small engines used in APUs for use on post-2007 trucks. Such a measure can be seen to produce minimal benefits, and could inhibit APU installation in cross-country trucks, resulting in higher impacts nationally. Furthermore, cost and regeneration issues for the APU DPF need to be addressed.

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